CERTS MicroGrid

Electric Distribution Transformation (EDT)

FY04 Annual Program and Peer Review Meeting

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Bob Lasseter

Representing the research team of:

LBNL, ORNL, PNNL, SNL

Electric Power Group, University of Wisconsin

Georgia Institute of Technology

Research Goals

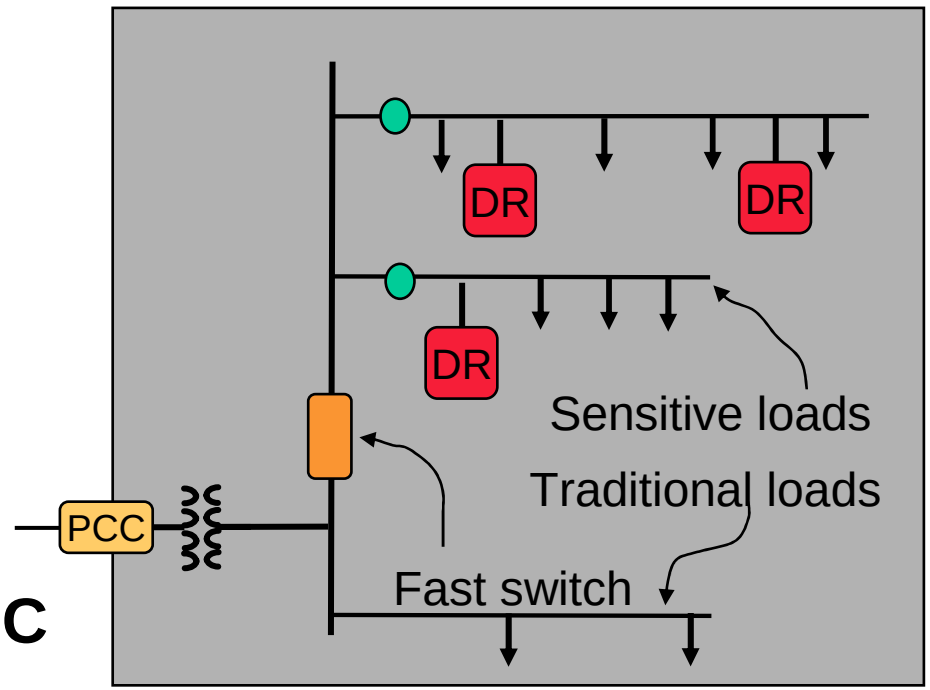
- Enable high levels of DER penetration
- Provide value to both the customer and the bulk power provider
- Insure **system** stability & reliable.
- Provide DER placement flexibility to optimize use of waste heat
- Design plug-and-play functionality into the DER
- Minimal dependences on communications

MicroGrid:

A Conceptual Solution

- Clusters sources with loads
- Single controllable unit
- Has a system focus
- Can operate in parallel or islanded
- Pier-to-pier source model (no master element)
- Source controllers use local information
- Designed to optimize use of waste heat

MicroGrid



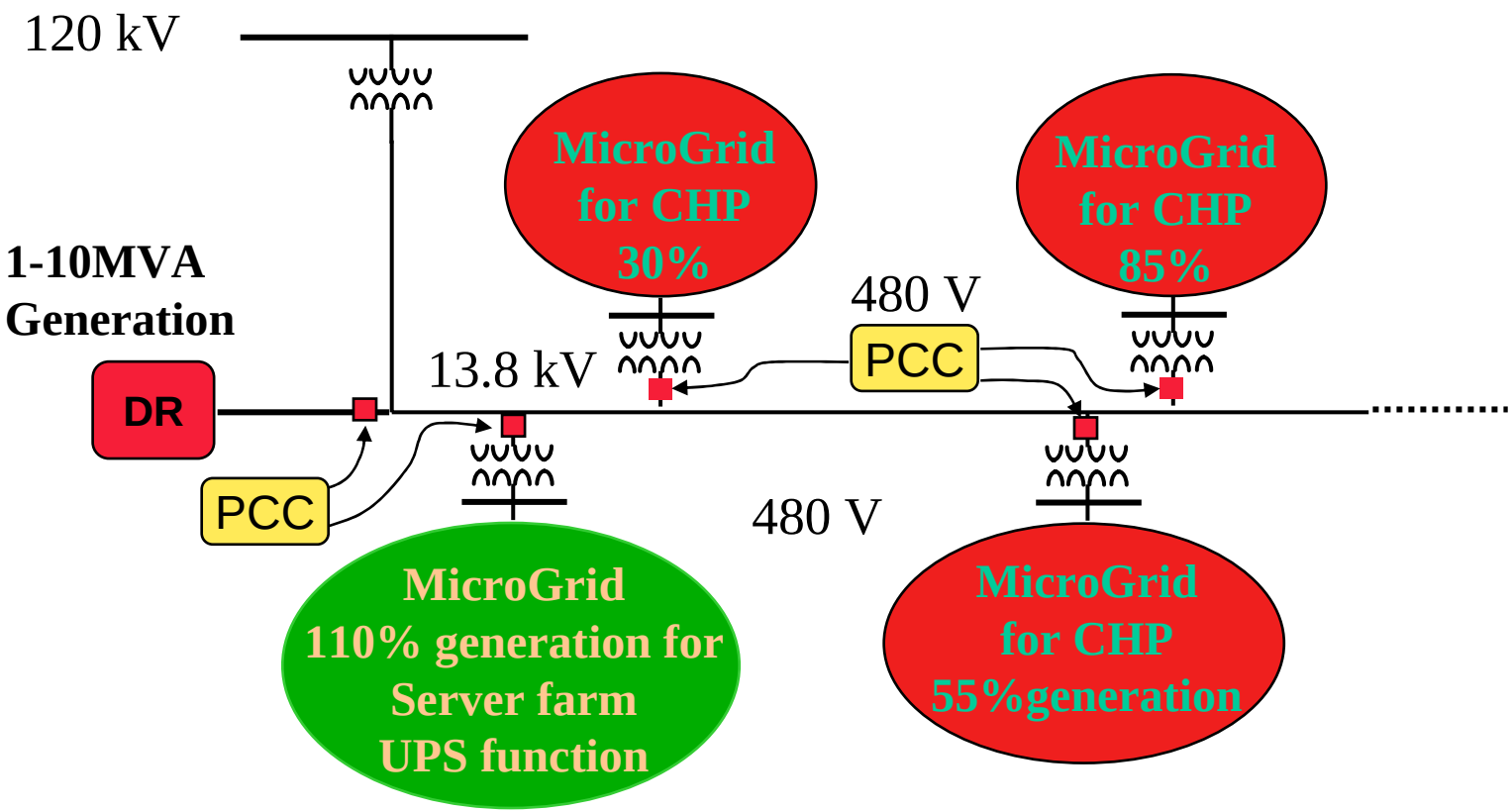
MicroGrid Side

- Local voltage control
- Power flow control
- Use of waste heat
- UPS functions
- Local redundancy

At PCC

- Dispatchable load
- Real-time pricing
- OK - 1547

Multiple MicroGrids



Research Activities

Analyses & Modeling Tools Development:

- Planning
- Local stability
- Customer adoption model (economics)

MicroGrid Test Bed:

- Demonstrate control & protection concepts
- Study operation, stability and power quality issues

Inclusion of non-inverter sources in Microgrids:

Control Requirements

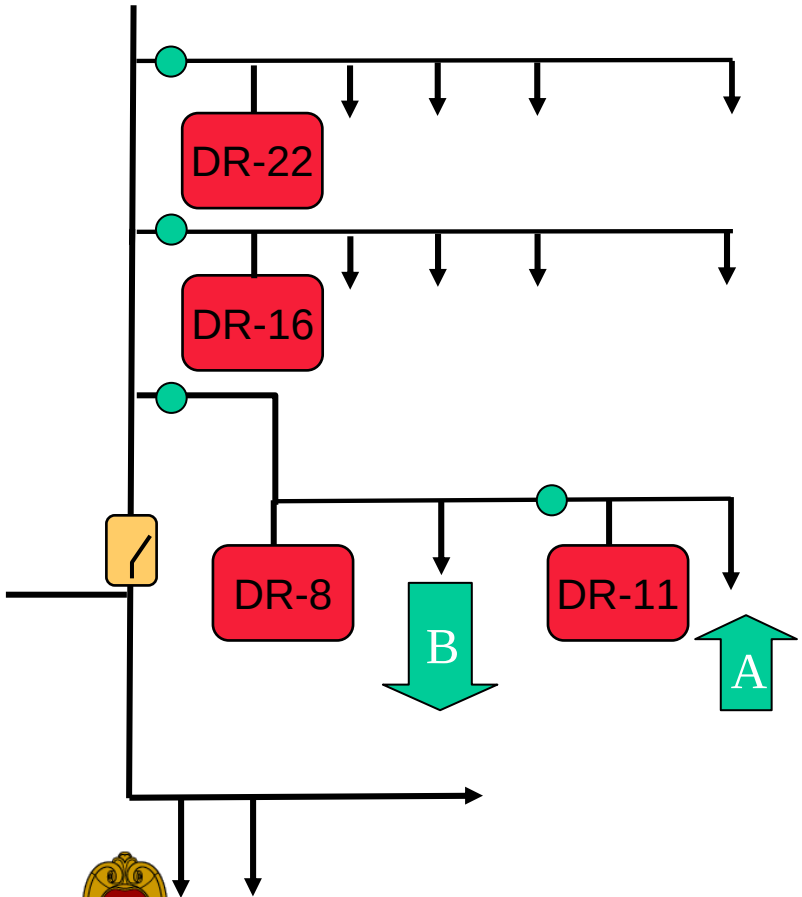
All operating cases (P/V control)

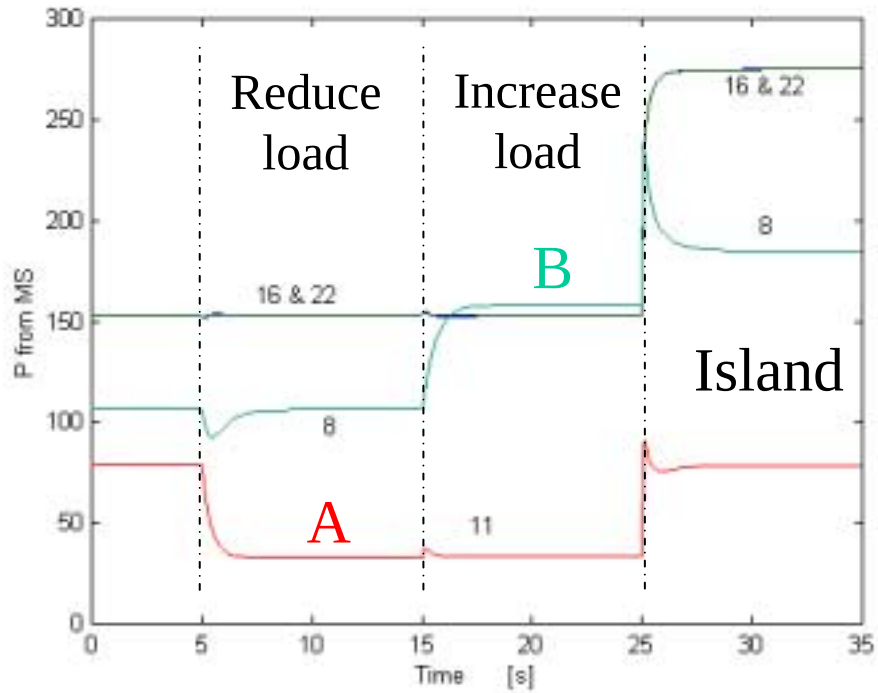
- Control feeder power
- Provide voltage control with droop

Island operation

- Provide power vs. frequency droop to track load's power needs

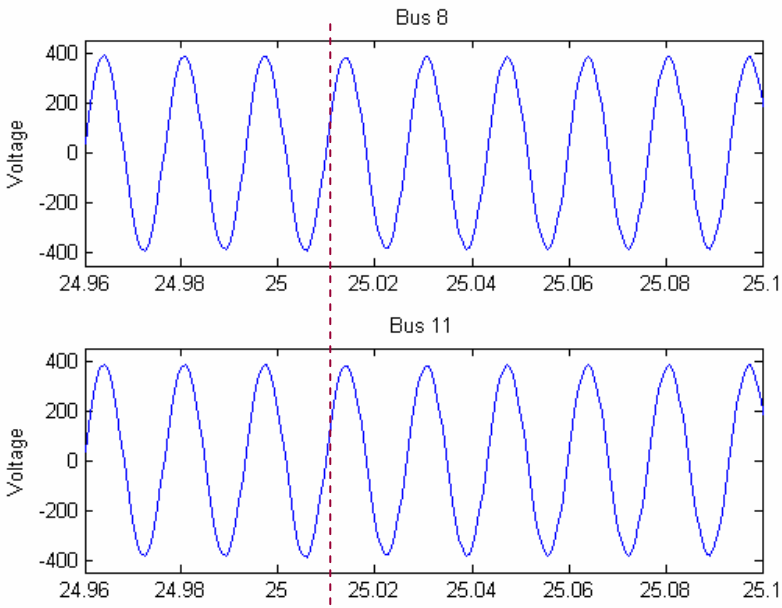
Example of Control Response





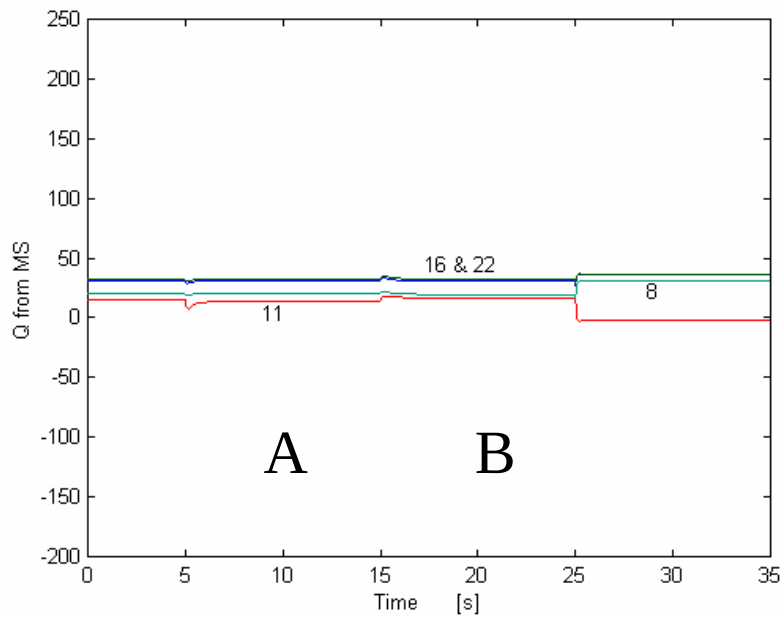
Power Output from Units

AC voltage & reactive power



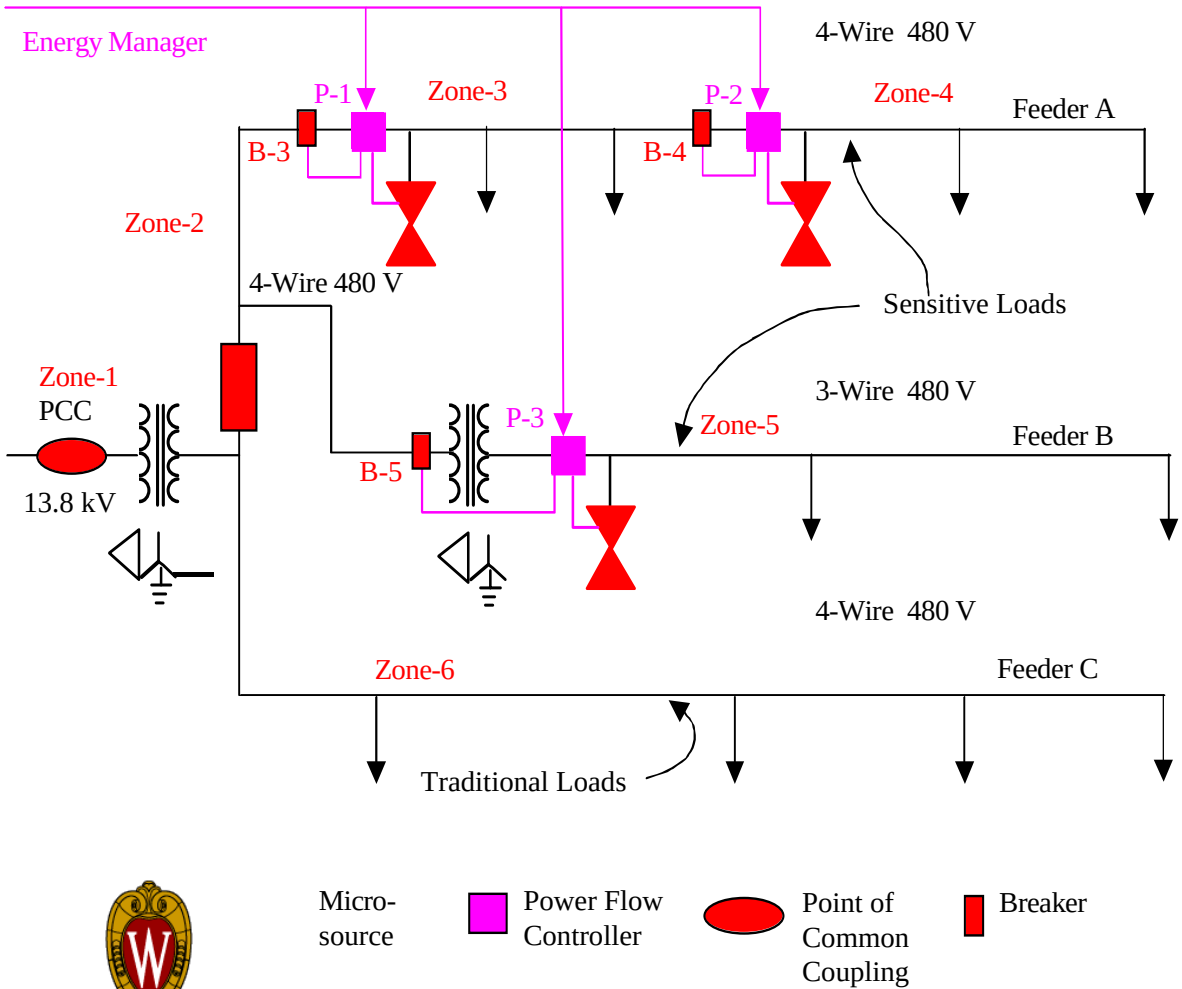
Grid connected

Islanded



all units have V-Q droop

Microgrid Test Bed



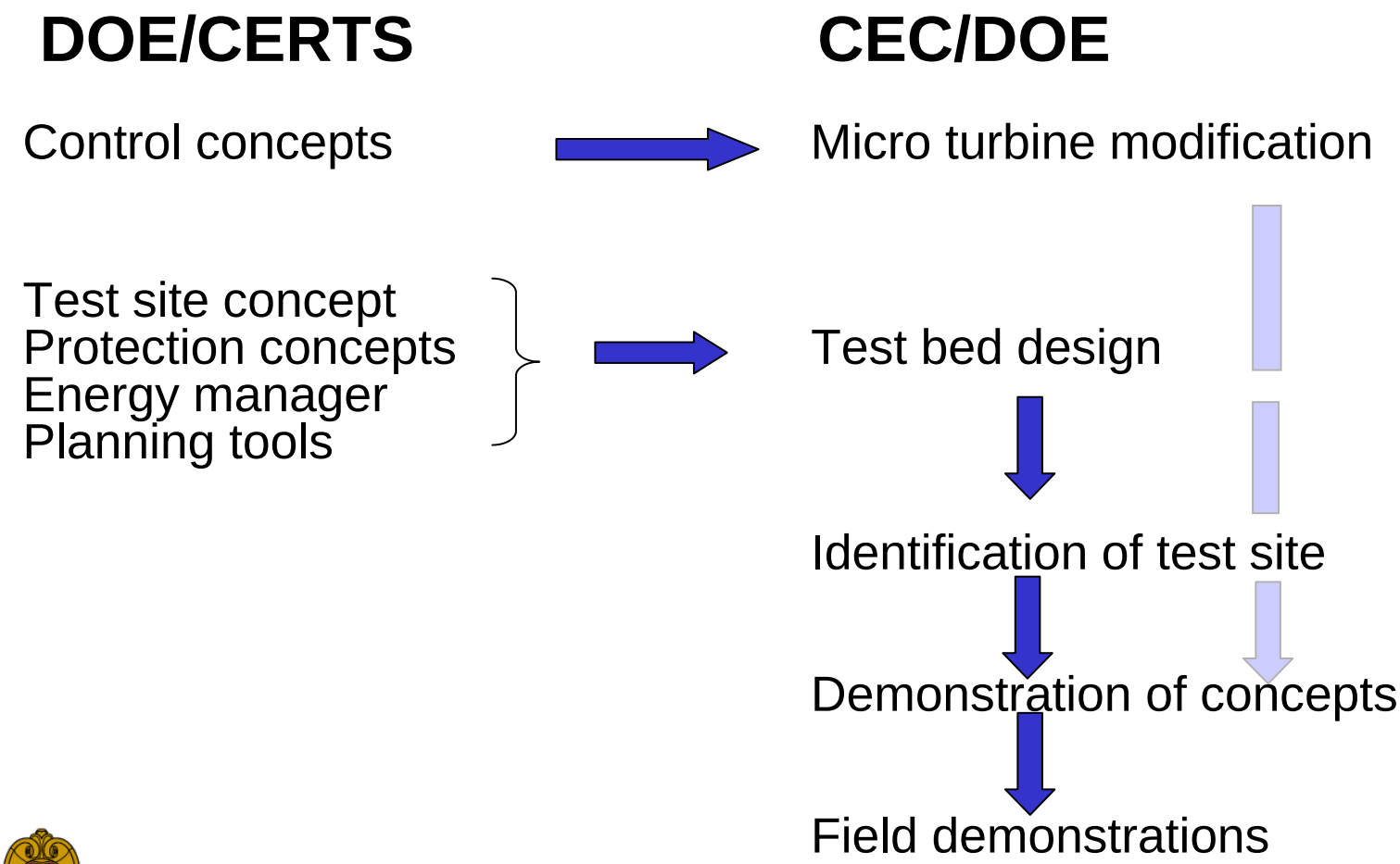
Grid connected

- Load changes
- Control of load flow
- Voltage control
- Protection
- P/V dispatch

Isolated operation

- Separation
- Load pick-up
- Voltage and Q control
- Protection
- Automatic re-syn.

Microgrid Activities



Conclusion

CERTS MicroGrid concepts are well developed and will soon be tested in a controlled laboratory setting.

We are interested in recruiting potential partners of field demonstrations to get involved NOW to ensure that the laboratory test resolve all key issues prior to moving into the field.

Contacts: Bob Lasseter: lasseter@engr.wisc.edu
John Stevens: jwsteve@sandia.gov